Intro to Pathology

David McQuillan, 2009

Based on previous work by Karole Hogarth, 2007

What is Pathology

- "The branch of medical science that studies the causes and nature and effects of diseases " (Princeton university, 2009)
- The word *pathology* comes from the Greek words
  - *pathos* meaning *disease*
  - *logos* meaning *a treatise*
  - a treatise of disease
- How does the study of pathology relate to massage therapy?

Course Overview

1. Introduction to Pathology
2. Musculoskeletal Pathology
3. Pathology of the integumentary, circulatory and nervous systems
4. Pathology of the Immune, Endocrine, Gastrointestinal, Renal & Reproductive systems

Language of Pathology

- Pathology is full of terms – some we are familiar with
  - Epidemic
  - Quarantine
  - Infectious
- Some terms need defining
  - Etiology
  - Pathogenesis
  - Morphology
  - Epidemiology

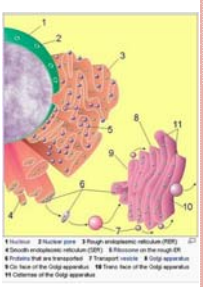
Etiology & Pathogenesis

- **Etiology** – The cause of disease
- **Pathogenesis** - "the sequence of cellular and tissue events that take place from the time of initial contact with an etiological agent until the ultimate expression of a disease" (Porth, 2002, p. 14)

Morphology

"The fundamental structure or form of cells or tissues" (Porth, 2002, p. 14)

- Morphological changes
- Histological changes
- Lesion



(Manske, 2008)

Epidemiology

The study of disease within a population

- **Incidence** – the number of new cases of a medical condition arising in a population over a specified time
- **Prevalence** – number of people who have the particular medical condition in a population at a particular point in time

Preparing for task 1

Diabetes mellitis (type 2) - Etiology

Preparing for task 1

Diabetes mellitis (type 2) - Pathogenesis

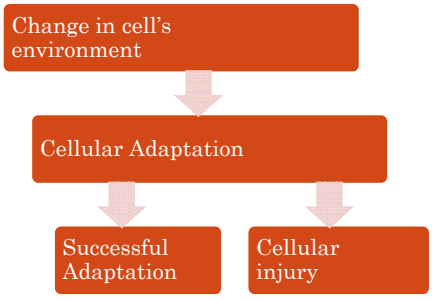
Preparing for task 1

Diabetes mellitis (type 2) - Morphology

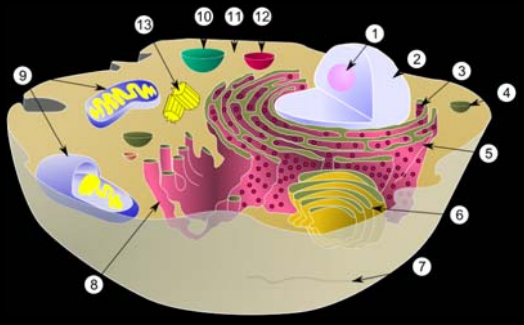
Preparing for task 1

Diabetes mellitis (type 2) - Epidemiology

The role of cells



Review



(Woland, 2006)

Cellular Adaptation

- Types of cellular adaptation
  - Atrophy
  - Hypertrophy
  - Hyperplasia

  } Change in cell size or number

  - Metaplasia
  - Dysplasia

  } Change in cell type

  - Intracellular Accumulations

Atrophy

- Shrinkage of cells, classified as:
  - **Physiologic** - due to decreased work load (e.g., decreased size of uterus following child birth, or disease)
  - **Pathologic**
    - denervation of muscle
    - diminished blood supply
    - nutritional deficiency

(http://theshrivers.us/

Hypertrophy

- Increase in the size of cells which results in enlargement of the organs

(Lynch, 2006)

(Jebas, 2006)

Hyperplasia

- Increased number of cells in an organ or tissue
  - **Physiologic** - hormonal (e.g breast & uterus during pregnancy)
  - **Compensatory** - regeneration of liver following partial hepatectomy
  - **Pathologic** - excessive hormonal stimulation viral infection (papilloma viruses);

Dysplasia

- Abnormal development resulting in cells that vary in shape, size, and appearance
  - Chronic inflammation or irritation
  - Cancer

Metaplasia

- One adult (differentiated) cell-type is replaced by another adult cell type.
- Thought to occurs through reprogramming of stem cells that are present in the tissue undergoing metaplastic changes.
- Causes
  - Exposure to chronic irritation
  - Exposure to a pathogen or carcinogen

Intracellular accumulations

- When cells cannot use or dispose of a substance, it may accumulate in the cytoplasm or in the nucleus
  - Internally created substances (lipids, proteins, carbohydrates, mealnin, bilirubin)
  - Externally created substances (environmental agents)
- Intracellular accumulations may
  - Be harmless
  - Impair functioning
  - Be toxic

Cell Injury

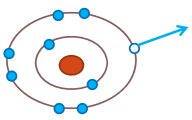
- Cell damage can be caused in a number of ways
  - Reaching limit of adaptation
  - Injury from physical agents
  - Radiation injury
  - Chemical injury
  - Injury from biologic agents
  - Injury from nutritional imbalances
- Affected cells may recover from the injury (reversible) or may die (irreversible)

Mechanisms of cell injury

- Direct cell injury
  - Heat
  - Mechanical injury
- Indirect cell injury
  - Free radicals
  - Hypoxia and ATP depletion
  - Impaired calcuim homeostasis

Free radical damage

- Free radical = "An atom that has a single unpaired electron in an outer orbit" (Porth, 2002, p. 103)
- Extremely reactive
  - Disruption of biologic processes
  - Damage to cell membranes
  - DNA Damage



- Sources of free-radicals
  - Some metabolic processes
  - Tobacco smoke, Some pollutants & chemicals, Radiation, Some medications

Hypoxic cell injury

- Causes of cell hypoxia
  - Circulatory impairments
  - Breathing pattern disorders
  - Fascial adhesion
  - Anemia
  - Oedema
- Hypoxia → Anaerobic metabolism
  - Reduced rate of ATP (energy) production → Failure of the sodium/potassium pump
  - Lactic acid build-up
  - Cell becomes more acidic (pH drops) → Destruction of cell structure

Impaired Calcium Homeostasis

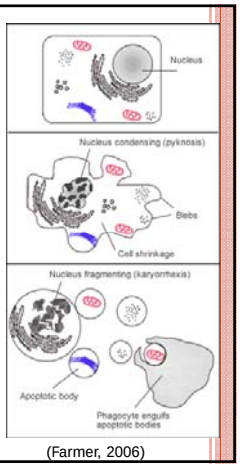
- Ischemia and certain toxins
  → increased flux across the cell membrane
  → release of calcium stored in mitochondria & endoplasmic reticulum
- Calcium triggers release of many intracellular enzymes, potentially causing
  - Damage to cell membranes
  - Damage to cytoskeleton
  - Destruction of ATP
  - Chromatic fragmentation

Cell Death

- Apoptosis – Natural cell death
  - A vital process that helps eliminate unwanted cells
  - Internally programmed event initiated by genes
- Necrosis – Unnatural cell death
  - Caused by cell injury

Apoptosis

- Every year, humans lose their body weight in cells through apoptosis
- The process is ongoing & at any moment in time millions of cells are being removed from the body
- When the process is regulated properly, we are oblivious to its occurrence



(Farmer, 2006)

Necrosis

- Unnatural cell death caused by cell injury.
- Often necrosis does not trigger the automatic breaking down & removal of cell material that is associated with apoptosis.
- In this case necrotic tissue must be removed by surgery.

(Chaldor, 2008)

Task 1

Tennis Elbow blog post

- Etiology
- Pathogenesis
- Morphological and/or histological changes
- Epidemiology
- Demonstrate a clear understanding of the meaning of each of the above terms.
- Must be written in your own words

Assessment

Course phase	Assessment
Introduction to pathology	Blog posts
Pathology – Musculoskeletal	Condition 1
Pathology - Integumentary, circulatory and nervous systems	Condition 2
Pathology - Immune, Endocrine, Gastrointestinal, Renal & Reproductive systems	Condition 3

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